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# Intention to kill: Tolerance and illegal persecution of Sumatrantigers and sympatric species

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## Abstract

Tolerance may lessen when wildlife adversely impacts people. Models from psychology can help elucidate how people make judgments, why they act accordingly, and whether beliefs and norms influence support for policy and intervention. Working in a globally important region for tigers, we estimated hunting prevalence for this endangered species and three sympatric taxa using methods for asking sensitive questions. We also investigated the relative strength of ethnicity and social-psychological predictors in influencing intention to hunt. Men's behavioral intention and perceptions differed by species: proconservation values were most prevalent for tiger, weakest for wild boar. Perceived behavioral control was the strongest predictor of hunting-intention; affect and injunctive norms were also important. The prominence of affect in determining intention suggests increasing environmental knowledge is unlikely to curb hunting. However, existing norms could be leveraged to incentivize behavior-change. Integrating behavior-change models into conservation science is crucial where strategies require changes in people's actions.

## KEYWORDS

affect, endangered species, hunting, Indonesia, norms, randomized response technique

## 1 | INTRODUCTION

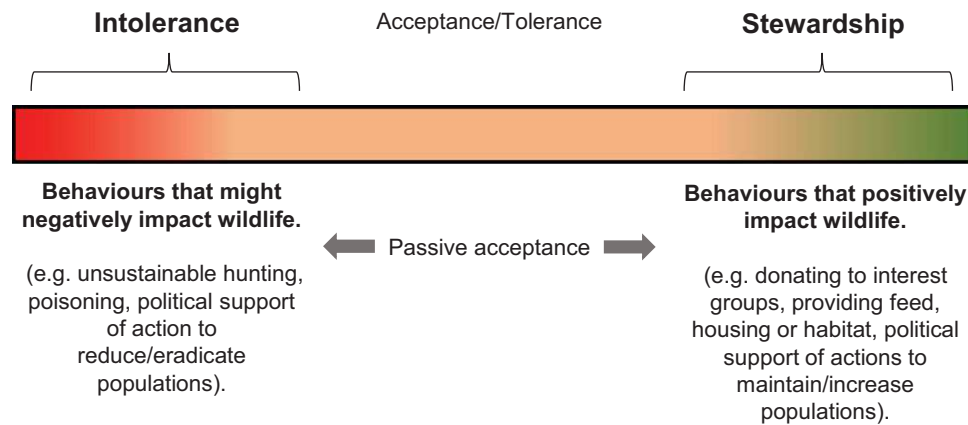
As rural populations grow, people can come into greater contact with wildlife. Where wildlife adversely impacts people, tolerance may be lessened (Redpath et al., 2013). Tolerance can be attitudinal, such as beliefs and values, and behavioral, such as killing or political lobbying (Bruskotter & Wilson, 2013). Viewed on a continuum (Figure 1), intolerance and stewardship are expressed through actions including killing animals or political lobbying for/or against a species, while acceptance/tolerance is a passive concept requiring no action

(Bruskotter & Fulton, 2012). This conceptualization permits the application of models and hypotheses from psychology to better our understanding of how people formulate judgments, and ultimately why they act as they do.

Observed behavior and behavioral intention are considered the best indicators of species tolerance, and antecedents of both have been studied extensively (Bruskotter & Fulton, 2012; Bruskotter & Wilson, 2013). For example, the theory of planned behavior (TPB) posits that behavioral intention, the immediate precursor to behavior, is shaped by attitude toward the behavior, perceived societal expectations (subjective

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**FIGURE 1** A conceptual model of wildlife conservation behavior adapted from Bruskotter and Fulton (2012). Intolerance and stewardship, expressed through actions, may be viewed as sitting at opposite ends of a spectrum of conservation-related behaviors. Acceptance/Tolerance sits in the middle and is not necessarily expressed through tangible acts

norms) and the perceived behavioral control (PBC) people believe they have (Fishbein & Ajzen, 1975).

The relative importance of TPB constructs varies across behaviors. For example, attitude best predicted ranchers' intention to kill jaguar in Amazonia (Marchini & Macdonald, 2012), while PBC was the strongest predictor of intention to hunt deer in the United States (Shrestha, Burns, Pierskalla, & Selin, 2012). Factors including affect and norms are also important predictors of behavior, as are the perceived probability of capture and punishment when examining rule-breaking (Nagin, 1998). Slagle, Bruskotter, and Wilson (2012) showed how affect, the instant feeling of goodness or badness people have to stimuli (Slovic, Finucane, Peters, & MacGregor, 2007; Wilson, 2008), influenced people's beliefs about wolf recovery. Positive emotions were associated with positive beliefs about wolf recovery, and had a greater influence on people's intention to engage in politically relevant behavior with respect to recovery, than knowledge of wolf biology (Slagle et al., 2012). Descriptive norms are one's perception of what most people do and they motivate individuals to act accordingly (Cialdini, Kallgren, & Reno, 1991). In contrast, injunctive norms are perceptions of what most people approve/disapprove of, defining how individuals act according to group rules (Cialdini et al., 1991). Both types of norms can trigger behavioral changes (Cialdini, 2003) and there is evidence they relate to conservation compliance. For example, in Taiwan people reporting little awareness (descriptive) and familial disapproval (injunctive) of killing leopard cats were less likely to have killed them (St. John, Mai, & Pei, 2015).

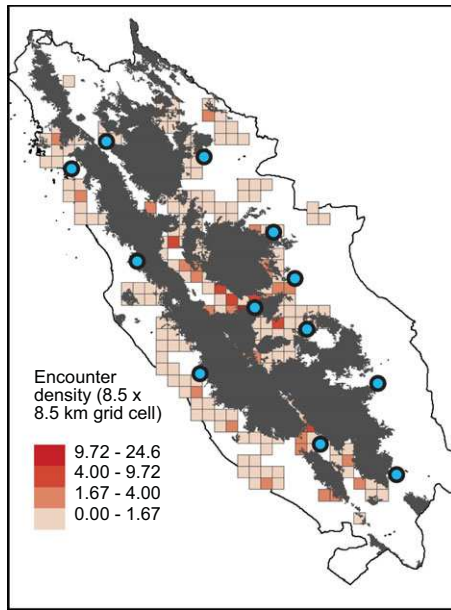
There is clear evidence that factors such as beliefs and affect, through their role in judgment and decision making, influence support for policy and management actions (Finucane, Alhakami, Slovic, & Johnson, 2000; Slagle et al., 2012) and that studies investigating the relative importance of behavioral predictors can usefully inform the design of conservation interventions (Marchini & Macdonald, 2012; Sla-

gle et al., 2012). Building on such studies, we investigate hunting prevalence of tigers and three sympatric species (boar, *Sus scrofa*; sambar, *Rusa unicolor*; pangolin, *Manis javanica*) in Sumatra, Indonesia. Furthermore, we measure the relative strength of ethnicity and social-psychological factors in influencing men's intention to hunt these species, which vary in protection status and perceived value to people.

Sumatran people are renowned for their diverse cultural and spiritual beliefs, which are thought to permeate their interactions with wildlife (Bakels, 2013). While Christianity may attribute souls exclusively to people, such spiritual elitism is incomprehensible to many Asians (McNeeley & Sochaczewski, 1988). Minangkabau and Kerincinese reportedly believe ancestral souls transfer to tigers, which then protect people, only attacking someone who breaks customary law (Bakels, 2013; McNeeley & Sochaczewski, 1988). We expected negative attitudes and affective responses, prokilling norms, low perceived probability of enforcement, and high PBC to be indicative of intention to kill; ethnicity was expected to be related to intention, particularly for tiger. Understanding people's relationship with different species can help develop a more complete picture of their ability to coexist with wildlife.

## 2 | METHODS

Identified as a global priority for tiger survival (Dinerstein et al., 2007), Kerinci Seblat National Park (KSNP) supports ~145 tigers, ~30% of the Sumatran population (Linkie, Chapron, Martyr, Holden, & Leader-Williams, 2006; Linkie et al., 2015), which exist despite encounters with people. Unlike other areas in Sumatra where forest has been converted to large-scale plantations, smallholder farming communities of different ethnicities border KSNP. Tigers occasionally attack livestock and people (Linkie, Dinata, Nofrianto, &



**FIGURE 2** Map of Kerinci Seblat landscape showing the density of human-tiger encounters and study areas sampled. Forest within and adjoining the Kerinci Seblat National Park is shown in dark shading.

Leader-Williams, 2007), and key prey species, boar and sambar, crop raid. While sambars are hunted for meat (Bakels, 2013), Islam prohibits consumption of boar so hunting for this purpose is unlikely. However, snares found in KSNP where all hunting is prohibited, are indiscriminate (Linkie et al., 2015). Regionally, increases in wildlife trade, particularly in tiger and pangolin, may be encouraging poaching of these species which, together with sambar, is prohibited throughout Indonesia (boar may be hunted outside of PAs).

Sampling was stratified across the landscape using information on 228 human-tiger incidents reported by local people (unpublished, Martyr). Each location was georeferenced and an observed incident density surface computed to identify low-, medium-, or high-incident study areas (Figure 2).

Following questionnaire piloting and revisions, data were gathered from a systematic sample of male and female heads-of-households between November 2014 and July 2016 by Indonesian enumerators. Sex of respondents was chosen at random and biased toward men because they are more likely than women to hunt (Wadley & Colfer, 2004; see Supporting Information).

Because hunting within KSNP is illegal, we used two forms of the randomized response technique (RRT), in addition to direct questions (DQ) to measure past hunting behavior. The proportion of people hunting was estimated using the forced response RRT (Warner, 1965). Equipment comprised 10 cards, 8 orange, one displaying, in Indonesian, “Yes” and another, “No.” Respondents selected one card prior to each sensitive question (Table 1). The “Yes” card demanded the prescribed answer “Yes”; the “No” card, “No.” The orange

**TABLE 1** Questions presented to RRT and aRRT respondents

	RRT	aRRT
1	In the last 12 months, have you tried to catch wild boar?	In the last 12 months, how many times have you tried to catch wild boar?
2	In the last 12 months, have you tried to catch sambar?	In the last 12 months, how many times have you tried to catch sambar?
3	Since the Mentawai earthquake and tsunami in 2010, have you tried to catch tiger?	Since the Mentawai earthquake and tsunami in 2010, how many times have you tried to catch tiger?
4	Since 2010, have you tried to catch pangolin?	Since 2010, how many times have you tried to catch pangolin?
5	Since 2010, have people from outside the village hunted tiger around here?	Since 2010, how many people from outside the village have hunted tiger around here?
6	Since 2010, have people in the village hunted tiger around here?	Since 2010, how many people in the village have hunted tiger around here?

Note: Men answered questions 1-7; women, questions 5-7.

card required an honest answer, “Yes,” or “No.” The chosen card was never revealed to enumerators and was replaced after each question.

We estimated the prevalence of hunting using the partial additive randomized response technique (aRRT; Robinson, St. John, Griffiths, & Roberts, 2015). Forty-eight cards were held in a stack, 12.5% were marked “zero” and required respondents to answer honestly by reporting the frequency of the behavior defined in the question (Table 1). All other answers were randomized by the numbers 1, 2, 3, and 4 displayed on the cards with the corresponding frequencies 22, 6, 8, and 6. If a numbered card was selected, then respondents were asked to add their answer to the number displayed on the card. The frequency distribution of the cards had a mean of 1.95 and a variance of 1.28.

Respondents were randomly assigned to RRT or aRRT and completed an example prior to study questions. Hunting pressure was also estimated by asking respondents to report their yes/no (for RRT participants) or numeric response (for aRRT respondents) to the hunting questions directly at the end of the questionnaire. Acceptability of RRT and aRRT was measured using two statements (Table S1).

The questionnaire also included nine sections (Table S2) designed to examine factors underlying men's intention to hunt specific species in the future, measured using a five-point ordinal scale (*very weak* = 1 to *very strong* = 5). Questions were asked separately for each species. To understand how people's emotional response influences intention to hunt,

respondents identified their position on two five-point semantic scales (good-bad; harmless-dangerous) after being shown an image of each animal. Many tools exist for measuring affect (Jacobs, 2012); to minimize cognitive burden, we used semantic scales which have proven proficient (Slagle et al., 2012). Answers to remaining questions were given on five-point Likert scales (*strongly agree* to *strongly disagree*). Attitudes toward the existence of each species were captured using two target-, action-, context-, and time-specific (Conner & Sparks, 2008) statements for example, “These days I think that [animal] in the village, on the farm land around the village and in the forest should be caught.” To investigate the relationship of descriptive and injunctive norms on people's intention to hunt, respondents were asked to indicate if they felt that most people try to hunt each animal, and if they felt social pressure to catch each animal. Respondents indicated how much perceived behavioral control they had over hunting by stating how much they agreed/disagreed to the following statement “If the opportunity arose, I am confident I could catch [animal] around here if I wanted to.” Two statements were used to capture the core elements of enforcement, the perceived probability of capture and perceived probability of penalty once captured. Crop and livestock loss to study species occurring in the preceding 12 months was also recorded.

## 2.1 | Data analysis

Data were analyzed using SPSS v22 (IBM Corp., 2013) and Rv.3.4.0 (R Development Core Team, 2012). The proportion of people admitting to hunting via RRT was calculated following St. John et al. (2015); aRRT data were estimated following Robinson et al. (2015; Supporting Information). For RRT, aRRT, and DQ, 95% confidence intervals were estimated from 1,000 bootstrapped samples. We considered there to be significant differences between estimates when confidence intervals did not overlap.

To examine relationships between men's intention to kill and beliefs and perceptions, we fitted cumulative logit mixed models using the R package Ordinal (Christensen, 2015) defined a prior drawing upon work of others (Fairbrass, Nuno, Bunnefeld, & Milner-Gulland, 2015; Marchini & Macdonald, 2012; Slagle et al., 2012). Affect, attitudes toward killing or conserving, injunctive and descriptive norms, PBC, and perceived probability of capture and punishment were all considered as potential fixed effects. Prior to modeling, these variables were scaled so that the higher the value, the less inclined people were to hunt in the future. Pearson's correlation coefficients were calculated for each pair of variables to avoid issues of multicollinearity. Men with missing data were excluded from models. Since estimates from RRT, aRRT, and DQ were consistently low and hence unsuitable for modeling, past hunting behavior was omitted from models.

## 3 | RESULTS

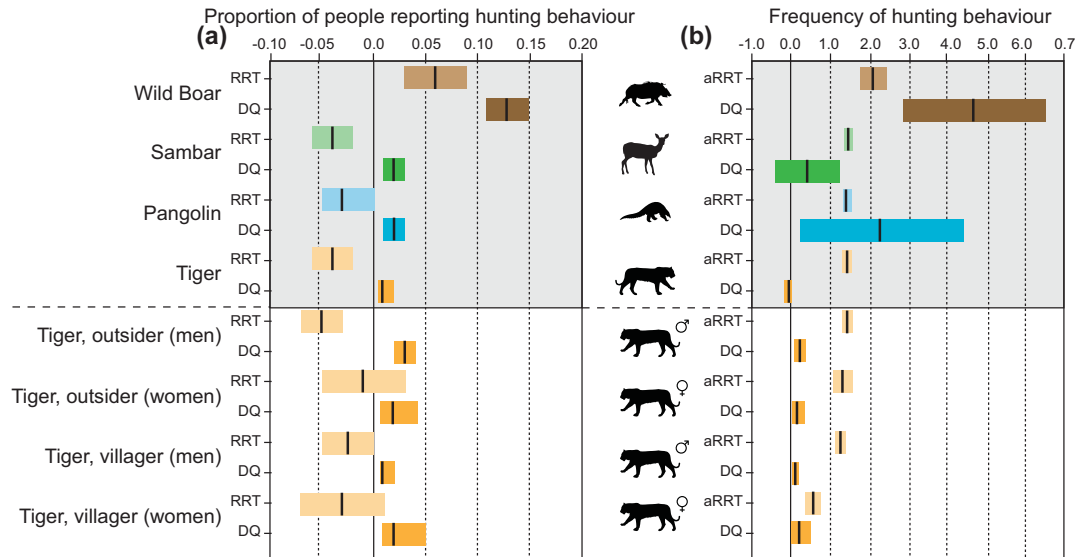
The questionnaire was completed by 2,386 people, missing data were  $\leq 1.7\%$  for model variables; exceptions were probability of capture or punishment ( $\leq 3.5\%$ ). Mean age was 44 (SE  $\pm 0.26$ ), most had completed elementary (53.2%) or junior (23.0%) school and 73.9% were male. The majority were Minangkabau (45.4%) or Melayu (32.4%), 2.9% were Kerinci-nese (Table S3). Most people growing crops reported losses to boar (85.1%), but few to sambar (13.3%); 0.6% lost livestock to tigers. Among men, all DQ estimates significantly exceeded those of the RRT (Figure 3a). However, the aRRT estimated significantly higher frequencies of sambar and tiger hunting than DQ; while higher, women's aRRT estimates of tiger hunting did not always differ significantly to DQ (Figure 3b). Men's DQ reports of tiger capture by outsiders and villagers did not differ significantly to women's (Table S4). RRT was considered significantly easier ( $U = 338,736.5$ ,  $z = -12.85$ ,  $P \leq 0.001$ ) and more private ( $U = 433,021.0$ ,  $z = -4.94$ ,  $P \leq 0.001$ ) than aRRT, but perceived ease and privacy was limited (Table S5).

Men's perceptions toward wildlife differed by species, with proconservation values most prevalent for tigers and weakest for boar (Figure 4). The perceived probability of capture, and punishment if captured, were significantly correlated for all species (Pearson's R;  $P < 0.05$ ; boar = 0.67, sambar = 0.78, tiger = 0.73, pangolin = 0.76), so probability of punishment was omitted from models. Across all species, PBC was the strongest predictor of intention to hunt in the future. As PBC declined, so did intention (Table 2). The relative importance of other variables differed by species. Injunctive norm was particularly important for tigers ( $\beta = -0.83$ ,  $P \leq 0.001$ ). By contrast, while a significant predictor for all other species, descriptive norm was weakly and not significantly related to men's intention to kill tigers ( $\beta = -0.10$ ,  $P = 0.30$ ). The affective measure of danger was negatively and significantly related to intention to kill (except sambar), implying greater perceived danger equates to greater intention. Contrary to expectations, affect for tiger and pangolin measured via “bad-good” was positively related to intention, indicating that intention to kill increased with perceived goodness. Attitudes toward killing significantly predicted intention across all species; the probability of capture was not significantly related to intention for tiger or pangolin (Table 2).

## 4 | DISCUSSION

Most respondents reported experiencing crop loss to boar, which 13% of men admitting to trying to catch on average seven times in the preceding year. Coupled with 2% of men admitting to hunting sambar once during the same period, this equates to a substantial number of indiscriminate snares





**FIGURE 3** (a) Proportion of respondents reporting hunting behavior estimated using RRT and DQ (men  $n = 778$ , women  $n = 282$ ) (b) Frequency of hunting behavior reported via aRRT and DQ (men  $n = 697$ , women  $n = 238$ ). Gray shading identifies data from men only, black bars indicate the mean, and bar length represents the 95% confidence interval. Tiger hunting conducted by people from outside the village (outsider) or from within the village (villager) is reported by men and women

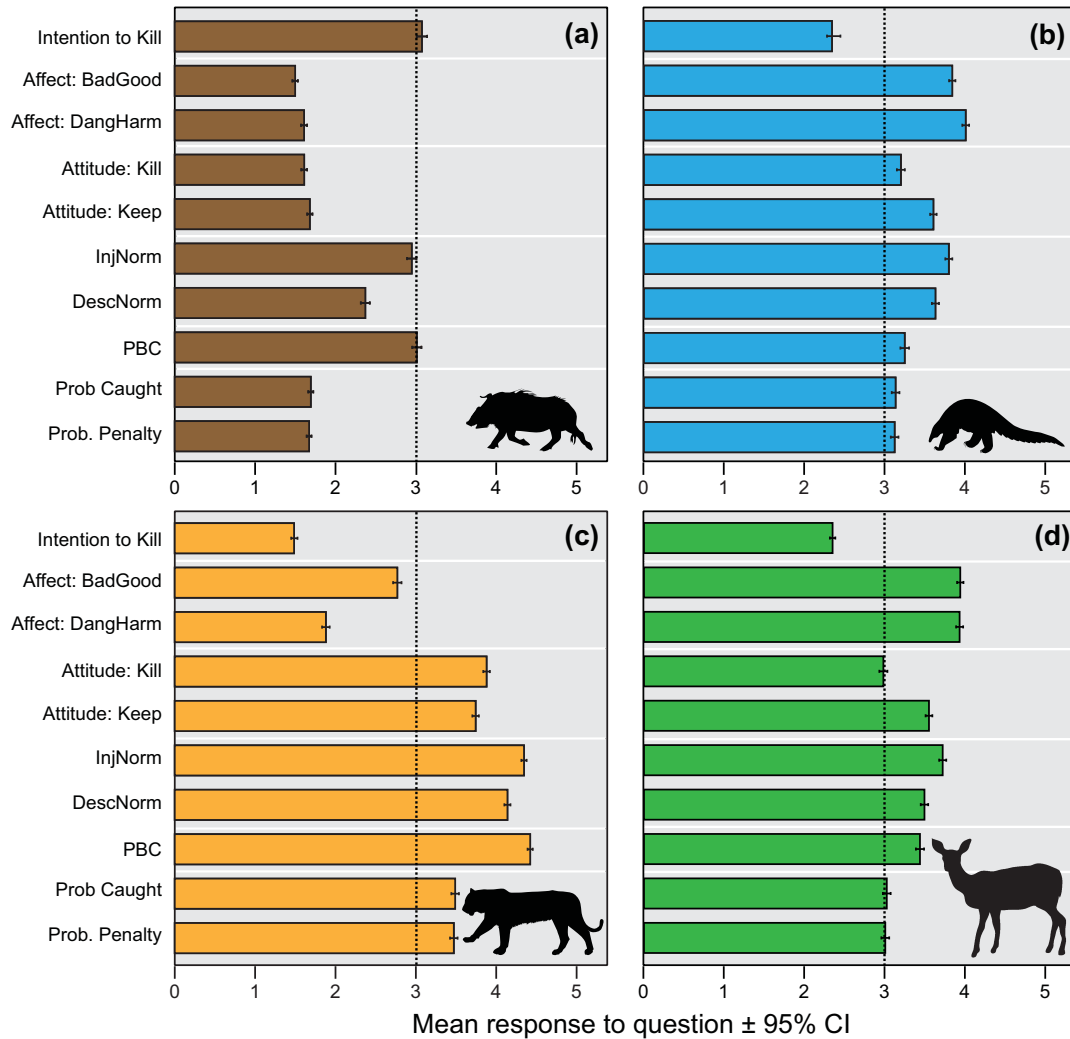
within or around KSNP. Indeed, 4,433 snares were removed by rangers between 2000 and 2010 (Linkie et al., 2015). Few men admitted (via DQ) to trying to catch tigers (1%) or pangolins (2%) since 2010. While 1% seems low, as >184,500 men live within 5 km of KSNP (Badan Pusat Statistik, 2010), 1% represents considerable poaching pressure. Indeed, 231 tiger snares were removed from KSNP between 2005 and 2014 (Risdiyanto et al., 2016). While recall is vulnerable to biases (Golden, Wrangham, & Brashares, 2013), we measured common events across short timeframes and where event rarity required longer periods (tiger hunting), actions were deemed memorable and thus accessible for recall.

As Indonesia modernizes and strong religious views permeate, worldviews held by groups such as the Minangkabau and Kerincinese, including that spirit tigers embody the souls of ancestors, are vulnerable. Incorporation into the market economy has increased the importance of money, which has encouraged some to sell tiger parts (Bakels, 2013; Bakels, Bhagwat, Drani, Infield, & Kidd, 2016). However, our models suggest that this may not be the result of beliefs attributed to particular ethnic groups. Ethnicity was incorporated into our models due to the prevalence of human-wildlife narratives in local ethnographic work. However, given evidence that sociodemographic characteristics generally fail to reveal underlying differences in how people relate to wildlife (Teel & Manfredi, 2010), we did not include other such variables.

Ethnicity was not related to men's intention to kill boar, tiger, or pangolin. However, intention to kill sambar was higher among Melayu. Hunting for sambar is known to peak prior to Idul Fitri (Risdiyanto et al., 2016), yet all ethnicities surrounding KSNP follow Islam so the link between Melayu

and sambar hunting warrants further exploration. Men's PBC over hunting was the strongest predictor of intention across all species; when PBC was weak, so too was intention. PBC was low for all species (Figure 4), but particularly tiger. Species-specific injunctive norms and attitudes toward hunting were also important predictors of behavioral intention; those not feeling social pressure to hunt did not intend to, nor did those reporting proconservation attitudes toward killing. Few men (<7%) perceive that others were killing tigers which may explain why descriptive norms, while related to intention to kill other studyspecies, were unimportant regarding behavior toward tigers. Contrary to expectations, for sambar, tiger, and pangolin, affect measured via "bad-good" was weakly and positively related to intention, implying that the greater the level of goodness associated with the animal, the greater the intention to kill one. Given the desirability of sambar meat and commercial value of tiger and pangolin, the possibility that men equated "goodness" to dietary or financial gains cannot be ruled out. However, affective perception of tigers as dangerous was a stronger driver of intention to kill than perceived goodness. As perceived dangerousness increased, so too did intention to kill. Initial responses to stimuli are frequently affective; they occur automatically but then guide information processing and judgment (Slovic et al., 2007). While conservation agencies may want stakeholders to rationally deliberate facts (e.g., the probability of tiger attack) divorced from emotion, evidence abounds to the contrary (Slagle et al., 2012; Wilson, 2008).

Observed behavior and behavioral intention are considered the best indicators of tolerance for a species (Bruskotter & Wilson, 2013). When studying illegal acts, behavioral



**FIGURE 4** Distribution of social variables reported by men and described with mean and 95% confidence interval (wild boar  $n = 1,739$ , pangolin  $n = 1,686$ , tiger  $n = 1,687$ , sambar  $n = 1,713$ ). With the exception of intention, variables are scaled such that the higher the value, the less inclined people were to hunt in the future. For example, an attitude toward killing or PBC score of 5 reflects disagreement with hunting and weak perceived control over performance of the behavior.

observation is challenging, so we used the RRT and the aRRT while also asking people to directly report their rule-breaking behavior. While there is substantial evidence that RRT returns higher estimates of rule-breaking under varied conservation contexts (Razafimanahaka et al., 2012; St. John et al., 2015), it was of limited use surrounding KSNP. However, despite being perceived by respondents as more difficult and less private than RRT, compared to asking men directly, aRRT estimated significantly higher hunting frequencies for four of six questions. An exception was boar, but since this species can be hunted beyond KSNP boundaries, this question is of limited sensitivity. Nevertheless, proximity to protected areas can impact the likelihood of people reporting rule-breaking behavior (Razafimanahaka et al., 2012).

Integrating behavior-change models into conservation science is crucial as emerging conservation strategies increasingly require widespread changes in people's actions (Reddy

et al., 2017). Many studies, including ours, measure predictors of behavior directly. While using value or belief-based measures, such as wildlife value orientations (Teel & Manfredi, 2010), provide advantageous insights into cognitive foundations of behavior, these values are less easily influenced by interventions; hence our focus on higher-order antecedents of behavior. We provide estimates of hunting and identify determining factors in a globally important tiger landscape. We conclude that awareness raising activities aimed at increasing knowledge of our study species may be of limited use in curbing men's intention to hunt given the prominence of affect in determining intention (Slagle et al., 2012). However, existing personal values could be leveraged to incentivize behaviorchange in a similar manner to that which has been operationalized to reduce energy consumption (Allcott & Rogers, 2014). Such an approach would appeal to people's affective intuitive and rational thinking simultaneously (Reddy et al.,

**TABLE 2** Maximum likelihood estimates and their standard errors derived from species-specific cumulative logit mixed models (study area as random effect) fitted to respondents' intention to kill a particular species

	Boar		Sambar		Tiger		Pangolin	
	$\beta$	SE	$\beta$	SE	$\beta$	SE	$\beta$	SE
Intercepts								
Very strong/strong intention	-3.29	0.29	-2.77	0.41	-5.33	0.58	-4.04	0.43
Strong intention/neutral	-5.35	0.31	-5.15	0.41	-6.81	0.55	-6.60	0.44
Neutral/weak intention	-6.20	0.31	-6.30	0.42	-7.87	0.56	-8.03	0.46
Weak intention/very weak intention	-8.28	0.34	-9.07	0.44	-10.93	0.59	-11.16	0.50
Affect: bad-good	<b>-0.34</b>	0.07	<u>0.10</u>	0.06	<i>0.17</i>	0.06	<i>0.22</i>	0.07
Affect: dangerous-harmless	<b>-0.23</b>	0.06	0.05	0.06	<b>-0.39</b>	0.06	-0.17	0.06
Attitude toward killing	<b>-0.37</b>	0.07	<b>-0.47</b>	0.06	<b>-0.29</b>	0.08	<b>-0.81</b>	0.07
Attitude toward conserving	0.08	0.08	-0.09	0.06	-0.06	0.08	-0.21	0.07
Descriptive norm	-0.15	0.05	<u>-0.12</u>	0.06	-0.10	0.09	-0.23	0.07
Injunctive norm	<b>-0.39</b>	0.05	<b>-0.37</b>	0.07	<b>-0.83</b>	0.11	<b>-0.40</b>	0.07
Perceived behavioral control	<b>-0.73</b>	0.05	<b>-0.81</b>	0.06	<b>-1.18</b>	0.10	<b>-0.85</b>	0.06
Perceived probability of capture	0	0.08	<u>-0.15</u>	0.06	-0.00	0.07	0.00	0.06
Age	<b>-0.02</b>	0.00	<b>-0.02</b>	0.00	-0.01	0.00	<b>-0.01</b>	0.00
Ethnicity: Minangkabau <sup>a</sup>	-0.23	0.14	<u>-0.21</u>	0.12	-0.06	0.17	-0.03	0.15
Ethnicity: other	-0.19	0.14	<u>-0.32</u>	0.14	-0.15	0.18	-0.16	0.16

Notes: <sup>a</sup>Reference category Melayu.

<sup>b</sup>The first rows represent intercepts (cut-points between categories), while the remainder are predictor coefficients.

Bold indicates significant variables at  $P < 0.001$ , italics  $P < 0.01$ , underlined  $P < 0.5$ , italic underlined  $P < 0.1$ .

2017). Applied in a standardized manner, our assessment of tolerance and behavioral intention could be upscaled to monitor threats to tigers or other conflict species. Doing so would enable preemptive or responsive interventions targeting the strongest predictor(s) and thus actors engaged in specific behaviors, which likely vary by site. Furthermore, where intervention design is informed by sociopsychological investigation, these data double as a monitoring and evaluation baseline.

Societal goals of conserving nature will unlikely be achieved with a blanket approach to enforcement. We recommend further interrogation of psychological components underpinning decision making including in the area of audience segmentation which strives to design optimal interventions for groups sharing common psychographic attributes (Kurtz, 2012). Our study provides evidence that behavior-change models provide informative material for practitioners seeking to encourage compliance and coexistence with wildlife.

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## SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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